PROCEEDINGS

OF

THE ROYAL SOCIETY.

1837. No. 29.

April 6th, 1837.

FRANCIS BAILY, Esq., V. P. and Treasurer, in the Chair.

Robert Hunter, Esq.; John Forbes Royle, M.D.; and Lieut-J. R. Wellsted, were severally elected Fellows of the Society.

A paper was in part read, entitled, "Further Observations on Voltaic Combinations; in a letter addressed to Michael Faraday, Esq., D.C.L. F.R.S., Fullerian Professor of Chemistry in the Royal Institution, &c. &c." By John Frederick Daniell, Esq., F.R.S., Professor of Chemistry in King's College, London.

April 13, 1837.

FRANCIS BAILY, Esq., V.P. and Treasurer, in the Chair.

William Archibald Armstrong White, Esq., was elected a Fellow of the Society.

The reading of Professor Daniell's paper on Voltaic Combinations was resumed and concluded.

In the course of an inquiry on the effects of changes of temperature upon voltaic action, the author was led to observe some curious disturbances and divisions of the electric current produced by the battery, arising from secondary combinations; the results of which observations form the subject of the present paper. He found that the resistance to the passage of the current was diminished by dissolving the sulphate of copper which was in contact with the copper in the standard sulphuric acid, instead of water. The increased effect of the current, as measured by the voltameter, was farther augmented by the heat evolved during the mixture; and wishing to study the influence of temperature in modifying these effects, the author placed the cells of the battery in a tub, filled with hot water. On charging the cells with a solution of muriate of ammonia in the interior, and aqueous solution of sulphate of copper in the exterior compartment, he observed that a portion of the current is discharged by the water in which the apparatus was immersed; its passage being indicated by the disengagement of gas betwixt the adjacent cells; in which case, one of the zinc rods is thrown out of action, and the copper of that cell acts merely as an electrode to the antecedent zinc. A saturated solution of common salt was

next placed in contact with the zinc, while the exterior compartments of the cells were filled with a saturated aqueous solution of sulphate of copper; but the effects were much diminished. It thus appeared that the substitution of solutions of the muriates for dilute sulphuric acid was in every way disadvantageous; and it was moreover found that, when the circuit was broken, the copper became seriously injured by their action, and by the formation of a submuriate of that metal.

Finding that the membranous tubes were unable to resist the action of the acid under the influence of high temperatures, the author substituted for them tubes of porous earthenware, of the same texture as that of which wine-coolers are commonly made, closed at their lower ends, and of the same height as the copper cells. The bottoms of the latter were fitted with sockets, for the reception of the tubes, and for confining them in their proper places; the perforated copper plates, or colanders, which held the solid sulphate of copper, passing over their upper ends. The tubes can be easily removed, and instantly replaced; and the facility of emptying and refilling them renders the addition of siphon-tubes unnecessary, except in very particular circumstances. A circular steam-vessel of tin plate was then provided, around which the cells could be placed upon blocks of wood, and closed in with a cover, containing a socket, which could, at pleasure, be connected with the steam pipe of a boiler. Two other sockets were also conveniently placed, provided with cork stoppers, through which the electrodes of the battery could pass, when the proper connexions were made. By using this apparatus the author determined that the increase of effect consequent on an augmentation of temperature is but in a slight degree dependent on an increase of conducting power in the electrolyte, but arises principally from its increased energy of affinity, producing a greater electromotive force.

In heating the battery by the steamer, it frequently happened that, when the thermometer had nearly reached the boiling point, and the action of the battery was at its maximum, a sudden cessation of its action would take place; and this suspension of power would continue for hours, provided the high temperature were maintained. On turning off the steam, and quickly cooling the apparatus, the action would return as suddenly as it had ceased, though, generally, not to the full amount. On closely examining the voltameter, on these occasions, it was found that the current was not wholly stopped; but that there existed a small residual current. This residual current was observed to be often directed in a course opposite to that which had before prevailed; and it was, in that case, the excess of a counter current, arising from a force which was acting in the contrary direction. The author found that variable currents might be produced, under ordinary circumstances, from the separate single cells of the battery when the whole series is connected by short wires. He proved by a series of experiments that the deoxidation of the oxide of copper by the hydrogen is not the exciting cause of the secondary currents; but that when the course of the main cur-

rent of the battery is obstructed by causing it to pass through the long wire of a galvanometer, or through the electrolyte of a voltameter, the course of the secondary current from each separate cell is always normal, or in the same direction: when, on the other hand, the battery-current is allowed to flow with the least possible resistance, as by completing the main circuit by a short wire, the secondary current of the separate cells is in the opposite direction. Hence the resistance may be so adjusted as that the secondary current shall altogether disappear, or alternate between the two directions.

The remainder of the paper is occupied with the detail of experiments made with a view to ascertain the effects of different degrees of resistance to the voltaic currents under a great variety of circumstances.

April 20, 1837.

The Right Honourable the Earl of BURLINGTON, V.P. in the Chair.

Frederic C. Skey, Esq., was elected a Fellow of the Society.

A paper was read in part, entitled, "Observations taken on the Western Coast of North America." By the late Mr. Douglas; with a report on his paper; by Major Edward Sabine, R.A., F.R.S. Communicated by the Right Honourable Lord Glenelg, one of His Majesty's Principal Secretaries of State, F.R.S., &c.

April 27, 1837.

FRANCIS BAILY, Esq., V.P. and Treas., in the Chair.

M. Antoine César Becquerel, Professor C. G. Ehrenberg, Admiral A. J. Von Krusenstern, and the Chevalier C. F. Mirbel, were elected Foreign Members of the Society.

The reading of Mr. Douglas and Major Sabine's paper, was resumed and concluded.

In the report prefixed to this paper, Major Sabine states, that Mr. Douglas was originally a gardener, and was, in the year 1833, recommended by Sir William Jackson Hooker to the late Mr. Joseph Sabine, who was then Secretary to the Horticultural Society of London, as a fit person to be employed by the Society in selecting and bringing to England a collection of plants from the United States of America. Having accomplished this mission to the complete satisfaction of his employers, he was next engaged on an expedition having similar objects with the former, but embracing a much larger field; namely, the tract of country extending from California to the highest latitude he might find it practicable to attain on the western side of the Rocky Mountains. Anxious to render to geographical and physical science all the services in his power, and to avail himself for that purpose of every opportunity which his visiting these hitherto imperfectly explored regions might afford him, he now endeavoured by diligent application to supply the deficiencies of his previous education. During the three months